

(19)



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(11)

EP 0 783 271 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

10.12.2003 Bulletin 2003/50

(21) Application number: **95935164.4**

(22) Date of filing: **27.09.1995**

(51) Int Cl.7: **A61B 17/04**

(86) International application number:
PCT/US95/12395

(87) International publication number:
WO 96/009798 (04.04.1996 Gazette 1996/15)

(54) **BONE ANCHOR INSTALLATION TOOL**

WERKZEUG ZUM ANBRINGEN EINES KNOCHENANKERS

DISPOSITIF D'INSTALLATION D'UN ELEMENT D'ANCRAGE DANS UN OS

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: **27.09.1994 US 312892**

(43) Date of publication of application:
16.07.1997 Bulletin 1997/29

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EP-A- 0 465 910 **US-A- 4 898 156**
US-A- 5 002 550 **US-A- 5 217 486**

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EP 0 783 271 B1

Description

[0001] This invention relates to an installation tool and a corresponding system, each for deploying a bone anchor in a bone, in accordance with the preamble of claim 1.

[0002] Bone anchors for attaching suture, bone and/or soft tissue to bone are well known in the art. See, for example, U.S. Patents Nos. 4,898,156; 5,046,513; 5,192,303; 4,899,743; 4,968,315; 4,946,468; 5,002,550; 5,207,679; and 5,217,486; and U.S. Patents 5,358,511; 5,505,735; 5,356,413; 5,417,712; 5,578,057; and 5,372,599.

[0003] Installation tools for deploying such bone anchors in bone are also well known in the art. See, for example, the foregoing U.S. patents.

[0004] Complete details of the construction and operation of the foregoing exemplary bone anchors and bone anchor installation tools are provided in the above-identified patents and patent applications.

[0005] EP-A-0 465 910 discloses a suture anchor and a driver assembly. The driver device has a shaft member attached or connected to a handle member. The shaft member and the handle member can be separate members securely fastened together. The handle is a hollow stainless tube member and the shaft is a stainless steel rod affixed in or to the handle. The anchor is situated for installation on an end projection of the shaft. A suture is positioned through a hole or opening in the anchor and the two ends of the suture are securely tied around fixation posts. In order to securely hold the sutures which are wrapped on the posts, O-rings are positioned on the stems of each of the posts.

[0006] While the bone anchor installation tools disclosed in the foregoing U.S. patents have proven more than satisfactory for most applications, it has been noted that certain problems can occur when using these installation tools in special situations.

[0007] More particularly, with some of the foregoing installation tools (e.g. the installation tools disclosed in U.S. Patents Nos. 4,898,156; 5,046,513; 5,192,303; and 4,899,743), the portion of the tool which carries the anchor (i) is wider than the body of the anchor itself, and (ii) must be positioned within the bone during anchor deployment. As a result of this construction, the bone hole must be formed larger than the body of the anchor in order to permit anchor deployment. This can be a disadvantage in certain situations where it may be necessary to form the smallest possible hole in the bone.

[0008] With others of the foregoing installation tools (e.g. the installation tools disclose in U.S. Patent No. 5,217,486 and U.S. Patent 5,578,057), the portion of the tool which carries the anchor does not need to be received by the bone during anchor deployment. Instead, only a relatively thin drive pin enters the bone during anchor deployment. The drive pin is formed so that it has a diameter less than the diameter of the anchor body. As a result of this construction, the bone hole can

be formed so that it has substantially the same width as the anchor body. However, it has also been found that where the installation tool is being used to set extremely small bone anchors, the drive pin must be so thin that it may bend or otherwise deform in certain circumstances. When this occurs, it may affect anchor deployment and/or render the installation tool unusable for, subsequent anchor deployments.

[0009] In addition to the foregoing, it has also been found that where the installation tools are being used in conjunction with anchors adapted to attach suture to bone, it can be very helpful to provide suture management means for controlling the disposition of the one or more free suture ends. In this respect it is noted that with some of the foregoing installation tools (e.g. the installation tools disclosed in U.S. Patents Nos. 4,946,468 and 5,002,550), such suture management means are provided. However, while such suture management means work well enough for most applications, it has been found that alternative suture management means could be helpful in some situations.

[0010] Accordingly, one object of the present invention is to provide an improved bone anchor installation tool.

[0011] Another object of the present invention is to provide an improved bone anchor installation tool, wherein the installation tool is adapted to deploy bone anchors of the type adapted to anchor suture to bone.

[0012] A further object of the present invention is to provide an improved bone anchor installation tool, wherein the installation tool is adapted to provide improved suture management means for managing the free end or ends of a suture or sutures attached to the bone anchor.

[0013] Yet another object of the present invention is to provide an improved bone anchor installation tool, wherein the installation tool is relatively easy to manufacture and relatively inexpensive to produce.

[0014] Still another object of the present invention is to provide a novel method for deploying a bone anchor in bone.

[0015] These and other objects of the present invention are achieved through the provision of a bone anchor installation tool defined in claim 1 and suture anchor deploying system defined in claim 8.

[0016] In one form of the invention, the installation tool comprises:

a body having a distal portion and a proximal portion, the distal portion terminating in a distal end surface and the proximal portion terminating in a proximal end surface, and further wherein an axial passageway extends between the distal end surface and the proximal end surface, with the distal end of the axial passageway being sized to receive at least a portion of a bone anchor therein;
a shaft slidably disposed in the axial passageway, the shaft terminating in a distal end surface and be-

ing adapted to move between (i) a first retracted position wherein the shaft's distal end surface is withdrawn sufficiently far into the interior of the axial passageway so as to allow at least a portion of a bone anchor to be received within the distal end of the axial passageway, and (ii) a second extended position wherein the shaft's distal end surface projects out of the distal end of the axial passageway;
 an annular rib formed outside of the passageway and on the exterior surface of the body; and
 an inwardly facing lip connected to the shaft for yieldably engaging the peripheral rib as the shaft moves from its first retracted position to its second extended position, whereby when the shaft is in its first retracted position, the interaction of the rib and the lip will prevent the shaft from moving into its second extended position until a sufficient distally-directed force is applied to the shaft so as to cause the lip yield out of engagement with the rib.

[0017] The installation tool also preferably comprises suture management means for managing a free end of a suture attached to a bone anchor disposed in the distal end of the axial passageway, the suture management means comprising a recess defining a first surface and an elastomer disposed in the recess so as to yieldably engage the first surface, whereby a free end of a suture may be forced between the first surface and the elastomer and retained there until thereafter forceably withdrawn.

[0018] In another form of the invention, the installation tool further comprises:

a shaft comprising a first portion having a first cross-section, a second portion having a second cross-section less than the first cross-section, and a shoulder defined by the intersection of the first and second portions;
 a shaft housing adapted to slidably receive the shaft, the shaft housing having a proximal cylindrical portion including an annular rib positioned a predetermined distance from a proximal end thereof, a fluted finger grip, and a stem extending distally from the fluted finger grip, the stem including a threaded portion and terminating in a chamfered nose;
 a shaft handle adapted to fixedly receive the proximal end of the shaft, the shaft handle comprising a slotted cylindrical portion having an inwardly facing lip disposed on a distal end thereof, the slotted cylindrical portion further including four slots, each of the slots being circumferentially positioned in spaced-apart opposing relation thereby defining four fingers adapted for gripping the annular rib of the shaft housing, a slotted flange disposed at a proximal end of the slotted cylindrical portion, the slotted flange having four slots each circumferentially disposed in spaced-apart opposing relation,

and a T-shaped post extending from a proximal surface of the slotted flange and adapted for retaining a suture free end, the T-shaped post comprising a central column having a hole adapted for fixedly receiving the proximal end of the shaft and a flange disposed at a proximal end of the central column, the central column extending distally from a flat inner surface of the flange;
 a rubber grommet disposed around the central column and adapted to releasably hold a length of suture attached to the suture anchor;
 a sleeve comprising a flared proximal end, and a slotted distal end, the sleeve being adapted for slidably receiving the shaft; and
 a sleeve handle comprising a proximal portion and terminating in a flat proximal end, a distal portion terminating in a rounded distal end, and a bore extending between the proximal end and the rounded distal end, the sleeve handle being adapted for slidably receiving the sleeve, the proximal portion of the sleeve handle further including a threaded counterbore adapted for releasably fastening the threaded portion of the stem, the threaded counterbore forming an internal angled shoulder with a proximal end of the bore and adapted to receive the flared proximal end of the sleeve, the sleeve handle further including finger grip depressions disposed in opposing circumferential relation thereon and adapted to receive a thumb and fingers of a user during installation of the suture anchor.

[0019] The novel bone anchor installation tool can be used in the following manner to deploy a bone anchor into bone. First, the installation tool has its shaft positioned in its first retracted position. Next, a suture anchor is positioned at least partially within the distal end of the axial passageway, and the free end of a suture (attached to the suture anchor) is positioned between the aforementioned first surface and the elastomer. Then the distal end of the installation tool is positioned against the top surface of a bone having a hole formed therein, with the suture anchor being aligned with the hole. Next, the installation tool's shaft is moved from its first retracted position to its second extended position so as to deploy the suture anchor in the bone. Finally, the free end of the suture is removed from between the aforementioned first surface and the elastomer.

Brief Description Of The Drawings

[0020] These and other objects, features and advantages of the present invention will be more fully disclosed in, or rendered obvious by, the following detailed description of the preferred embodiment of the invention, which is to be considered together with the accompanying drawings wherein like numbers refer to like parts and further wherein:

Fig. 1 is a side elevational view of a fully assembled installation tool, wherein the installation tool's shaft is in its first retracted position;

Fig. 2 is a side elevational view of the same fully assembled installation tool, wherein the installation tool's shaft is in its second extended position;

Fig. 3 is a side elevational view, in partial section, of the installation tool's shaft subassembly;

Fig. 4 is a side elevational view of a sleeve which constitutes part of the installation tool;

Fig. 5 is an end view showing the distal end of the sleeve;

Fig. 6 is a side elevational view of a sleeve handle which constitutes part of the installation tool;

Fig. 7 is an end view showing the proximal end of the sleeve handle;

Fig. 8 is a side elevational view of a shaft which constitutes part of the installation tool's shaft subassembly;

Fig. 9 is an end view showing the proximal end of the shaft;

Fig. 10 is a side elevational view of a shaft housing which constitutes part of the installation tool's shaft subassembly;

Fig. 11 is a cross-sectional view taken along line 11-11 of Fig. 10;

Fig. 12 is an end view showing the proximal end of the shaft housing;

Fig. 13 is a side view in section of a shaft handle which constitutes part of the installation tool's shaft subassembly;

Fig. 14 is an end view showing the proximal end of the shaft handle;

Fig. 15 is a side view partially in section showing a bone anchor installed in the distal end of the bone anchor installation tool of the present invention;

Fig. 16 is a side view partially in section showing the bone anchor and bone anchor installation tool of Fig. 16, wherein the distal end of the installation tool is in engagement with the outer surface of a bone and the bone anchor is about to be deployed in that bone; and

Fig. 17 is a view like that of Fig. 16, except that the bone anchor has been deployed in the bone.

Detailed Description Of The Preferred Embodiment

[0021] Looking first at Figs. 1 and 2, a bone anchor installation tool 5 is shown which comprises a preferred embodiment of the present invention. Installation tool 5 generally comprises a shaft subassembly 10 (Figs. 1-3), a sleeve 15 (Figs. 1, 2, 4 and 5) and a sleeve handle 20 (Figs. 1, 2, 6 and 7).

[0022] More particularly, and looking now at Fig. 3, shaft subassembly 10 generally comprises a shaft 25, a shaft housing 30, a shaft handle 35 and a rubber grommet 37.

[0023] Shaft 25 is shown in greater detail in Figs. 8

and 9. Shaft 25 comprises a first cylindrical portion 40 and a second cylindrical portion 45. Second cylindrical portion 45 has a smaller diameter than first cylindrical portion 40. First cylindrical portion 40 and second cylindrical portion 45 together define an annular shoulder 50. First cylindrical portion 40 terminates in a distal end surface 55. Second cylindrical portion 45 terminates in a proximal end surface 60.

[0024] Shaft housing 30 is shown in greater detail in Figs. 10-12. Shaft housing 30 comprises a fluted finger grip 65 having a flat distal surface 67. A stem 70 extends distally away from the fluted finger grip's flat distal surface 67. Stem 70 includes a threaded portion 75 and terminates in a chamfered distal nose 80. Shaft housing 30 also comprises a cylindrical portion 85 extending proximally away from fluted finger grip 65. Cylindrical portion 85 includes an annular rib 90 and terminates in a flat proximal end surface 95. A central passageway 100 extends through shaft housing 30, from chamfered distal nose 80 of stem 70 to flat proximal end surface 95 of cylindrical portion 85.

[0025] Shaft handle 35 is shown in greater detail in Figs. 13 and 14. Shaft handle 35 comprises a slotted cylindrical portion 105, a slotted flange 110 and a T-shaped post 115. More particularly, slotted cylindrical portion 105 comprises an inwardly facing lip 125 and four slots 130. Slots 130 are disposed in equally-circumferentially-spaced relation about the circumference of slotted cylindrical portion 105. In essence, slots 130 divide slotted cylindrical portion 105 into four longitudinally-extending fingers. Slotted flange 110 comprises four slots 135. Slots 135 are disposed in equally-circumferentially-spaced relation about the circumference of slotted flange 110. Slots 135 of slotted flange 110 are aligned with slots 130 of slotted cylindrical portion 105. Slotted flange 110 terminates in a flat distal surface 137 and in a proximal surface 140. The flange's proximal surface 140 is preferably rounded somewhat at its circumferential edge 142, adjacent to where proximal surface 140 meets flat distal surface 137. T-shaped post 115 comprises a cylindrical central column 145 and an annular flange 150. Flange 150 terminates in a rounded proximal surface 155 and in a flat distal surface 160. A rounded circumferential edge 165 is defined by the intersection of rounded proximal surface 155 and flat distal surface 160. A hole 170 extends axially through slotted flange 110 and into T-shaped post 115, and communicates with the interior of slotted cylindrical portion 105. Hole 170 is coaxial with, and communicates with, another hole 171 which opens on rounded proximal surface 155.

[0026] Rubber grommet 37 (Figs. 1-3) comprises a toroidal shaped piece of elastomer adapted to be positioned on shaft handle 35. More particularly, rubber grommet 37 is adapted to be fit over the shaft handle's cylindrical central column 145 so as to be compressed between flat proximal surface 140 of slotted flange 110 and flat distal surface 160 of annular flange 150.

[0027] Shaft subassembly 10 is assembled as follows. First, the shaft's second portion 45 is passed through the shaft housing's central passageway 100 until the shaft housing's chamfered distal nose 80 engages the shaft's annular shoulder 50. Then shaft handle 35 is passed over the proximal end of shaft housing 30 until the proximal end of shaft 25 enters the shaft handle's hole 170. The proximal end of shaft 25 is then made fast in hole 170 by welding, using access hole 171. On account of the foregoing construction, shaft 25 and shaft handle 35 thereafter operate as a single unit, with shaft housing 30 being slidably captured on shaft 25 between the shaft's annular shoulder 50 and the shaft handle's distal surface 137, as will hereinafter be described in further detail. Once this has been accomplished, rubber grommet 37 is then mounted onto the shaft handle's cylindrical central column 145.

[0028] Looking next at Figs. 4 and 5, sleeve 15 comprises a distal portion 175 and a proximal portion 180. Distal portion 175 comprises four slots 185. Slots 185 are equally-circumferentially-spaced about the circumference of sleeve 15. Slots 185 open on the sleeve's distal end surface 190. The proximal portion of sleeve 15 is flared outwardly at 195 and terminates in a proximal end surface 200. A central passageway 203 extends between distal end surface 190 and proximal end surface 200.

[0029] Looking next at Figs. 6 and 7, sleeve handle 20 comprises a distal portion 205 and a proximal portion 210. Distal portion 205 terminates in a rounded distal end surface 215 and proximal portion 210 terminates in a flat proximal end surface 220. Sleeve handle 20 also includes a bore 225 and a counterbore 230. Bore 225 opens on the sleeve handle's rounded distal end surface 215 and counterbore 230 opens on the sleeve handle's flat proximal end surface 220. Bore 225 and counterbore 230 meet at an internal angled shoulder 235. The proximal portion of counterbore 230 is threaded at 240. A plurality of finger grip depressions 245 are formed in the outer surface of sleeve handle 20.

[0030] The complete bone anchor installation tool 5 is assembled as follows. First, sleeve 15 is passed distal end first through counterbore 230 and bore 225 of sleeve handle 20, until the sleeve's flared portion 195 engages the sleeve handle's internal angled shoulder 235. Then the assembled shaft subassembly 10 is passed distal end first through counterbore 230 of sleeve handle 20 and central passageway 203 of sleeve 15, until chamfered distal nose 80 of shaft subassembly 10 enters counterbore 230 of sleeve handle 20. Shaft subassembly 10 is then rotated so that the shaft housing's threaded portion 75 engages threads 240 of sleeve handle 20. Shaft subassembly 10 is turned until the shaft housing's flat distal surface 67 engages the sleeve handle's proximal end surface 220. At this point, chamfered distal nose 80 of shaft subassembly 10 will make a close fit with proximal end surface 200 of sleeve 15, so as to maintain the longitudinal position of sleeve 15 relative

to the remainder of the installation tool. At the same time, however, sleeve 15 is free to rotate relative to the remainder of the installation tool.

[0031] When bone anchor installation tool 5 is assembled in the foregoing manner, its shaft 25 will be free to move between (i) a first retracted position (Fig. 1) wherein the shaft's annular shoulder 50 is substantially in engagement with the shaft housing's chamfered distal nose 80, and the shaft handle's inwardly facing lip 125 is on the proximal side of, and substantially in engagement with, the shaft housing's annular rib 90, and the shaft's distal end surface 55 is withdrawn into the interior of sleeve 15; and (ii) a second extended position (Fig. 2) wherein the shaft handle's flat distal end surface 137 is in engagement with the shaft housing's flat proximal end surface 95, and the shaft handle's inwardly facing lip 125 is on the distal side of, and substantially displaced from, the shaft housing's annular rib 90, and the shaft's distal end surface 55 protrudes a substantial distance beyond the sleeve's distal end surface 190.

[0032] Bone anchor installation tool 5 is preferably used to deploy a suture anchor of the sort disclosed in the aforementioned U.S. Patent No. 5,217,486 and/or a suture anchor of the sort disclosed in the aforementioned U.S. Patent No. 5,417,712, i.e., bone anchor installation tool 5 is preferably used to deploy a suture anchor of the sort comprising (i) a generally cylindrical body, (ii) a pair of flexible barbs extending laterally out of the side of the body, and (iii) suture attachment means for attaching a length of suture to the body. Of course, bone anchor installation tool 5 may also be used to deploy other types of bone anchors in bone or other types of fasteners in a workpiece, so long as such bone anchor or fastener is compatible with the present invention.

[0033] Bone anchor installation tool 5 is intended to be used as follows. First, installation tool 5 is positioned so that its shaft 25 is in its aforementioned first retracted position, wherein the shaft's annular shoulder 50 is substantially in engagement with the shaft housing's chamfered distal nose 80, and the shaft handle's inwardly facing lip 125 is on the proximal side of, and substantially in engagement with, the shaft housing's annular rib 90, and the shaft's distal end surface 55 is withdrawn into the interior of sleeve 15 (Fig. 1). It is to be appreciated that bone anchor installation tool 5 will be inclined to remain in its aforementioned first retracted position until it is thereafter forced to assume another position, inasmuch as the shaft housing's annular rib 90 will tend to inhibit passage of the shaft handle's inwardly facing lip 125.

[0034] Next, and looking now at Fig. 15, a suture anchor 300 is loaded into the distal end of sleeve 15 so that the suture anchor's proximal end 305 rests against the shaft's distal end surface 55, with the suture anchor's two barbs 310 extending out through two of the sleeve's slots 185 and the suture anchor's two lengths of suture 315 extending out through the other two of the sleeve's slots 185.

[0035] The two lengths of suture 315 are then extended tautly back along the length of the installation tool and threaded through one or more of the shaft handle's slots 135 before being wound tightly around the shaft handle's cylindrical central column 145, in the space between rubber grommet 37 and the shaft handle's surface 140. The resilient engagement of rubber grommet 37 with the shaft's surface 140 thereafter serves to keep the two lengths of suture 315 securely in place at the proximal end of the installation tool, yet allow a surgeon to easily pull the two lengths of suture free from the installation tool when needed. Furthermore, by ensuring that the two lengths of suture 315 extend tautly back along the length of installation tool 5 prior to being secured in place via rubber grommet 37, the two lengths of suture 315 will serve to ensure that suture anchor 300 cannot become prematurely disengaged from the distal end of the installation tool.

[0036] Next, and looking now at Fig. 16, the installation tool is manipulated so as to position the distal portion of suture anchor 300 within the top of a hole 320 formed in a bone 325, with the distal end of sleeve 15 engaging the top surface 330 of the bone.

[0037] Suture anchor 300 can then be deployed in bone 325 by pressing on the shaft handle's proximal surface 155 so as to urge the installation tool's shaft 25 into its aforementioned second extended position. As this occurs, the shaft handle's inwardly facing lip 125 will be forced over the shaft housing's annular rib 90 as the shaft handle's flat distal end surface 137 moves into engagement with the shaft housing's flat proximal end surface 95 and the shaft's distal end surface 55 moves out of the sleeve's distal end. As a consequence of this action, suture anchor 300 will be driven out of the distal end of sleeve 15 and into bone 325, with the suture anchor's barbs 310 securing the anchor in place and with the two lengths of suture 315 extending back out of the bone hole to the installation tool. The two lengths of suture 315 may then be unwound from the installation tool before the installation tool is removed from the surgical site.

Advantages Of The Present Invention

[0038] Numerous advantages are obtained by using the present invention.

[0039] For one thing, an improved bone anchor installation tool is provided.

[0040] For another thing, an improved bone anchor installation tool is provided, wherein the installation tool is adapted to deploy bone anchors of the type adapted to anchor suture to bone.

[0041] Also, an improved bone anchor installation tool is provided, wherein the installation tool is adapted to provide improved suture management means for managing the free end or ends of a suture or sutures attached to the bone anchor.

[0042] Furthermore, an improved bone anchor instal-

lation tool is provided, wherein the installation tool is relatively easy to manufacture and relatively inexpensive to produce.

[0043] Still other advantages of the invention will be obvious to those skilled in the art.

Modifications Of The Preferred Embodiment

[0044] It will, of course, be appreciated that certain modifications may be made to the foregoing preferred embodiment of the present invention without departing from the scope of the present invention.

[0045] Thus, for example, more than four slots 185 may be provided in the distal end of sleeve 15, where the installation tool is to be used in conjunction with a bone anchor of the sort having more than two barbs and/or more than two free suture ends.

[0046] Furthermore, more or less than four slots 130 may be provided in slotted cylindrical portion 105, and/or more or less than four slots 135 may be provided in slotted flange 110.

[0047] Also, fluted finger grip 65 could be formed with an exterior surface which is knurled rather than fluted, or finger grip 65 could be formed with a relatively smooth surface if desired.

[0048] Additionally, suture could be held to the proximal end of the installation tool by wrapping it around cylindrical central column 145 between rubber grommet 37 and the shaft handle's flat surface 160, rather than between rubber grommet 37 and the shaft handle's surface 140.

[0049] These and other changes will be obvious to a person skilled in the art, and are considered to be within the scope of the present invention.

Claims

1. An installation tool (5) for deploying a bone anchor (300) in bone (325), said installation tool (5) comprising:

a body (15, 30) having a distal portion and a proximal portion, said distal portion terminating in a distal end surface (190) and said proximal portion terminating in a proximal end surface, and further wherein an axial passageway (100, 203) extends between said distal end surface (190) and said proximal end surface, with said distal end surface (190) of said axial passageway being sized to receive at least a portion of said bone anchor (300) therein;

a shaft (25) slidably disposed in said axial passageway (100, 203), said shaft (25) terminating in a distal end surface (55) and being adapted to move between (i) a first retracted position wherein said shaft's distal end surface (55) is withdrawn sufficiently far into the interior of said

axial passageway (100, 203) so as to allow at least a portion of said bone anchor (300) to be received within said distal end (190) of said axial passageway (100, 203), and (ii) a second extended position wherein said shaft's distal end surface (55) projects out of said distal end surface (190) of said axial passageway (100, 203); an annular rib (90) formed on the exterior surface of said body (15, 30); and

characterized by

an inwardly facing lip (125) of said shaft (25) for yieldably engaging said annular rib (90) as said shaft (25) moves from its said first retracted position to its said second extended position, whereby when said shaft (25) is in its said first retracted position, the interaction of said annular rib (90) and said inwardly facing lip (125) will prevent said shaft (25) from moving into its said second extended position until a sufficient distally-directed force is applied to said shaft (25) so as to cause said inwardly facing lip (125) to yield out of engagement with said annular rib (90); and in that said annular rib (90) is formed outside of said axial passageway (100, 203), and said inwardly facing lip (125) is connected to said shaft (25).

2. An installation tool (5) according to claim 1 wherein said installation tool further comprises suture management means for managing a free end of a suture (315) attached to said bone anchor (300) disposed in said distal end (190) of said axial passageway (100, 203), said suture management means comprising a recess (140, 145, 160) defining a first surface and an elastomer (37) disposed in said recess (140, 145, 160) so as to yieldably engage said first surface, whereby a free end of a suture (315) may be forced between said first surface and said elastomer (37) and retained there until thereafter forceably withdrawn.
3. An installation tool (5) according to claim 1 wherein said shaft (25) further comprises a first portion (40) having a first cross-section, a second portion (45) having a second cross-section less than said first cross-section, and a shoulder (50) defined by the intersection of said first and said second portions (40, 45); wherein said body (15, 30) comprises a fluted finger grip (65), and a stem (70) extending distally from said fluted finger grip (65), said stem (70) including a threaded portion (75) and terminating in a chamfered nose (80); wherein said inwardly facing lip (125) is connected to said shaft (25) by a shaft handle (35) adapted to fixedly receive a proximal end (60) of said shaft (25),

said shaft handle (25) comprising a slotted cylindrical portion (105) forming said inwardly facing lip (125) disposed on a distal end thereof, said slotted cylindrical portion (105) further including four slots (130), each of said slots (130) being circumferentially positioned in spaced-apart opposing relation thereby defining four longitudinally extending fingers adapted for gripping said annular rib (90) of said body (30), a slotted flange (110) disposed at a proximal end of said slotted cylindrical portion (105), said slotted flange (110) having four slots (135) each circumferentially disposed in spaced-apart opposing relation, and a T-shaped post (115) extending from a proximal surface (140) of said slotted flange (110) and adapted for retaining a suture free end, said T-shaped post (115) comprising a central column (145) having a hole (170) adapted for fixedly receiving said proximal end (60) of said shaft (25) and a flange (150) disposed at a proximal end (155) of said central column (145), said central column (145) extending distally from a flat inner surface (160) of said flange (150); and a rubber grommet (37) disposed around said central column (145) and adapted to releasably hold a length of suture (315) attached to said suture anchor (300);

a sleeve (15) comprising a flared proximal end (200) and a slotted distal end (190), said sleeve (15) adapted for slidably receiving said shaft (25); and wherein said body further comprises

a sleeve handle (20) comprising a proximal portion (210) and terminating in a flat proximal end (220), a distal portion (205) terminating in a rounded distal end (215), and a bore (225) extending between said proximal end (220) and said rounded distal end (215), said sleeve handle (20) being adapted for slidably receiving said sleeve (15), said proximal portion (210) of said sleeve handle (20) further including a threaded counterbore (230) adapted for releasably fastening said threaded portion (75) of said stem (70), said threaded counterbore (230) and said bore (225) meeting at an internal angled shoulder (235) to engage said flared proximal end (200) of said sleeve (15), said sleeve handle (20) further including finger grip depressions (245) disposed in opposing circumferential relation thereon and adapted to receive a thumb and fingers of a user during installation of said suture anchor (300).

4. An installation tool according to claim 3 wherein said shaft's (25) first and second cross-sections are cylindrical.
5. An installation tool according to claim 3 wherein said fluted finger grip (65) comprises a plurality of circumferentially disposed flutes.
6. An installation tool according to claim 3 wherein

said flange (110) of said shaft handle (35) further comprises a rounded proximal surface (140) and a flat distal surface (137) so as to define a rounded circumferential edge (142) therebetween.

7. An installation tool according to claim 3 wherein said proximal end (60) of said shaft (25) is welded in said hole (170) of said shaft handle (35). 5
8. A system for deploying a bone anchor (300) for anchoring a suture in a hole (320) formed in a bone (325), said system comprising: 10
- (i) said suture anchor (300) comprising a generally cylindrical housing, a pair of flexible barbs (310) extending laterally out of the side of said housing, and suture attachment means for attaching a length of suture (315) to said housing; and 15
- (ii) an installation tool (5) for deploying said suture anchor (300) in bone (325), said installation tool (5) comprising: 20

a body (15, 30) having a distal portion and a proximal portion, said distal portion terminating in a distal end surface (190) and said proximal portion terminating in a proximal end surface, and further wherein an axial passageway (100, 203) extends between said distal end surface (190) and said proximal end surface, with said distal end surface (190) of said axial passageway being sized to receive at least a portion of said suture anchor (300) therein; 25

a shaft (25) slidably disposed in said axial passageway (100, 203), said shaft (25) terminating in a distal end surface (55) and being adapted to move between (i) a first retracted position wherein said shaft's distal end surface (55) is withdrawn sufficiently far into the interior of said axial passageway (100, 203) so as to allow at least a portion of said suture anchor (300) to be received within said distal end (190) of said axial passageway (100, 203), and (ii) a second extended position wherein said shaft's distal end surface (55) projects out of said distal end surface (190) of said axial passageway (100, 203); 30

an annular rib (90) formed outside of said axial passageway (100, 203) and on the exterior surface of said body (15, 30); 35

an inwardly facing lip (125) of said shaft (25) for yieldably engaging said annular rib (90) as said shaft (25) moves from its said first retracted position to its said second extended position, whereby when said shaft (25) is in its said first retracted position, the 40

interaction of said annular rib (90) and said inwardly facing lip (125) will prevent said shaft (25) from moving into its said second extended position until a sufficient distally-directed force is applied to said shaft (25) so as to cause said inwardly facing lip (125) to yield out of engagement with said annular rib (90); and 45

suture management means for managing a free end of a suture (315) attached to said suture anchor (300) when said suture anchor is disposed in said distal end (190) of said axial passageway, said suture management means comprising a recess (140, 145, 160) defining a first surface and an elastomer (37) disposed in said recess (140, 145, 160) so as to yieldably engage said first surface, whereby a free end of a suture (315) may be forced between said first surface and said elastomer (37) and retained there until thereafter forceably withdrawn, wherein said inwardly facing lip (125) is connected to said shaft (25). 50

Patentansprüche

1. Werkzeug zum Anbringen eines Ankers (300) in einen Knochen (325), aufweisend:

einen Körper (15,30) mit einem distalen und einem proximalen Teil, wobei der distale Teil in einer distalen Endfläche (190) und der proximale Teil in einer proximalen Endfläche endet, und ein axialer Gang (100, 203) sich zwischen der distalen Endfläche (190) und der proximalen Endfläche erstreckt, wobei die ferne Endfläche (190) des axialen Gangs so bemessen ist, dass zumindest ein Teil des Ankers (300) darin aufgenommen werden kann;

einen gleitend in dem axialen Gang (100, 203) angeordneten Schaft (25), wobei der Schaft in einer distalen Endfläche (55) endet und so angepasst ist, dass er sich hin und her bewegt zwischen (i) einer ersten eingefahrenen Position, bei der die distale Endfläche (55) ausreichend weit in das Innere des axialen Gangs (100, 203) zurückgezogen ist, damit zumindest ein Teil des Ankers (300) innerhalb des distalen Endes (190) des axialen Gangs (100, 203) aufgenommen werden kann und (ii) einer zweiten ausgefahrenen Position, bei der die distale Endfläche des Schafts (55) aus der distalen Endfläche (190) des axialen Gangs (100, 203) herausragt;

eine ringförmige Rippe ausgebildet an der Au-

ßenfläche des Körpers (15, 30); und **gekennzeichnet durch** eine nach innen zeigende Lippe (125) des Schafts (25), die in die besagte ringförmige Rippe (90) nachgebend einrastet, da sich der Schaft (25) von seiner ersten eingefahrenen Position zu seiner zweiten ausgefahrenen Position bewegt, wobei, wenn der Schaft (25) sich in seiner ersten eingefahrenen Position befindet, das Zusammenwirken der ringförmigen Rippe (90) und der nach innen zeigenden Lippe (125) den Schaft (25) daran hindern wird, sich in seine zweite ausgefahrte Position zu bewegen, bis eine ausreichende distale Kraft auf den Schaft (25) ausgeübt wird, um die nach innen gerichtete Lippe (125) aus der Einrastung mit der ringförmigen Rippe (90) heraus zu lösen und insofern die ringförmige Rippe außerhalb des besagten axialen Gangs (100, 203) ausgebildet ist und die nach innen gerichtete Lippe (125) mit dem Schaft (25) verbunden ist.

2. Werkzeug (5) gemäß Anspruch 1, wobei das Werkzeug Suture-Faden-Handhabungsmittel aufweist, um ein freies Ende eines Suture-Fadens (315), welches an dem Anker (300) angebracht und an dem distalen Ende (190) des axialen Gangs 100, 203) angeordnet ist handzuhaben, wobei das Suture-Faden-Handhabungsmittel eine Vertiefung (140, 145, 160) aufweist, die eine erste Fläche und ein Elastomer definiert, welches in der Vertiefung (140, 145, 160) angeordnet ist, um in die erste Fläche nachgebend einzurasten, wobei ein freies Ende eines Suture-Fadens (315) zwischen die Fläche und das Elastomer (37) gezwängt und dort gehalten werden kann, bis es gewaltsam zurückgezogen wird.
3. Werkzeug (5) nach Anspruch 1, wobei der Schaft (25) außerdem einen ersten Teil (40) aufweist, der einen ersten Querschnitt aufweist, einen zweiten Teil (45), der einen zweiten Querschnitt aufweist, der kleiner ist als der erste Querschnitt und durch den Schnittpunkt des besagten ersten und zweiten Teils (40, 45) einen Absatz (50) definiert; wobei der Körper (15, 30) einen gerillten Fingergriff (65) aufweist und einen Stamm (70), der sich distal von dem gerillten Fingergriff (65) ausdehnt und der Stamm (70) einen Gewindeteil (75) umfasst und in einer abgeschrägten Nase (80) endet; wobei die nach innen gerichtete Lippe (125) mit dem Schaft (25) durch einen Schaftgriff (35) verbunden ist, der angepasst ist, um ein proximales Ende (60) des Schafts (25) fest aufzunehmen, wobei der Schaftgriff (25) einen gespaltenen zylindrischen Teil (105) aufweist, der die nach innen gerichtete Lippe (125), die an einem distalen Ende angeordnet ist, umschließt, wobei der gespaltenen zylindrische Teil (105) außerdem vier Spalten (130) enthält, von

denen jede Spalte (130) ringsum mit Abstand in gegenüberliegender Beziehung positioniert ist und dadurch vier der Länge nach ausdehnende Finger definiert, die angepasst sind, um die ringförmige Rippe (90) des Körpers (30) zu greifen, einen gespaltenen Flansch (110) angeordnet an einem proximalen Ende des gespaltenen zylindrischen Teils (105), wobei der gespaltenen Flansch (110) vier Spalten (135) aufweist, jede ringsum mit Abstand gegenüberliegend angeordnet, und einen T-förmigen Pfosten (115), der sich von einer proximalen Fläche (140) des gespaltenen Flansches (110) ausdehnt und angepasst ist zur Aufnahme eines freien Suture-Fadenendes, wobei der besagte T-förmige Pfosten (115) eine zentrale Säule (145) aufweist mit einem Loch (170) angepasst, um das proximale Ende (60) des besagten Schafts (25) unbeweglich aufzunehmen und einen Flansch (150) angeordnet an einem proximalen Ende (155) der zentralen Säule (145), wobei die zentrale Säule (145) sich distal von einer flachen inneren Fläche (160) des Flansches (150) erstreckt; und eine Gummidichtung (37) angeordnet um die zentrale Säule (145) herum und angepasst um eine Länge des Suture-Fadens (315), die an dem Suture Anker (300) befestigt ist lösbar zu halten; eine Hülse (15), die ein sich erweiterndes proximales Ende (200) und ein gespaltenes distales Ende (190) aufweist, wobei die Hülse (15) angepasst ist, um den Schaft (25) gleitend aufzunehmen; und wobei der Körper weiterhin einen Hülsegriff (20) aufweist, der einen proximalen Teil (210) aufweist und in ein flaches proximales Ende (220) endet, einen distalen Teil (205) der in ein gerundetes distales Ende (215) endet, und eine Bohrung (225), die sich zwischen dem proximalen Ende (220) und dem gerundeten distalen Ende (215) erstreckt, wobei der Hülsegriff (20) so angepasst ist, dass er die Hülse (15) gleitend aufnimmt, und der proximale Teil (210) des Hülsegriffs (20) außerdem eine Gewindebohrung (230) aufweist, die angepasst ist, um den Gewindeteil (75) des Schafts (70) lösbar zu befestigen, die Gewindebohrung (230) und die Bohrung (225) treffen sich an einem internen angewinkelten Absatz (235), um das sich erweiternde proximale Ende (200) der Hülse (15) einzurasten, der Hülsegriff (20) weist ferner Fingergriffvertiefungen auf (245), die in gegenüberliegender umlaufender Beziehung zueinander angeordnet und angepasst sind, um einen Daumen und Finger eines Benutzers während der Installation des Suture Ankers (300) aufzunehmen.

4. Werkzeug nach Anspruch 3, wobei der erste und zweite Querschnitt des Schafts zylindrisch ist.
5. Werkzeug nach Anspruch 3, wobei der gerillte Fingergriff (65) eine Mehrheit von umlaufend angeord-

neten Rillen aufweist.

6. Werkzeug nach Anspruch 3, wobei der Flansch (110) des Schaftgriffs (35) außerdem eine gerundete proximale Fläche (140) aufweist und eine flache distale Fläche (137) und damit zwischen diesen eine gerundete umlaufende Kante (142) definiert. 5
7. Werkzeug nach Anspruch 3, wobei das proximale Ende (60) des Schafts (25) in das Loch (170) des Schaftgriffs (35) eingeschweißt ist. 10
8. System, um einen Knochen Anker (300) zur Verankerung einer Suture in ein Loch (320) einzusetzen, welches in einem Knochen (325) geformt wurde, wobei das besagte System folgendes aufweist: 15

- i) der Suture-Anker (300) weist ein hauptsächlich zylindrisches Gehäuse auf, ein paar flexibler Widerhaken (310), die sich lateral aus der Seite des Gehäuses erstrecken und Suture Befestigungsmittel zur Befestigung einer Länge des Suture-Fadens (315) an das Gehäuse; und 20
- ii) ein Werkzeug (5), um den Suture-Anker (300) in Knochen (325) einzusetzen, wobei das Werkzeug (5) folgendes aufweist: 25

einen Körper (15, 30), der einen distalen Teil und einen proximalen Teil aufweist, wobei der distale Teil in eine distale Endfläche (190) und der proximale Teil in einer proximalen Endfläche endet und außerdem ein axialer Gang (100, 203) sich zwischen der distalen Endfläche (190) und der proximalen Endfläche erstreckt, wobei die distale Endfläche (190) des axialen Gangs so bemessen ist, dass sie mindestens einen Teil des Suture Ankers (300) darin aufnehmen kann; 30

einen Schaft (25) der gleitend in dem axialen Gang (100, 203) angeordnet ist, wobei der Schaft (25) in einer distalen Endfläche (55) endet und angepasst ist, um sich zwischen (i) einer ersten eingefahrenen Position, bei der die distale Endfläche (55) des Schafts ausreichend weit in das Innere des axialen Gangs (100, 203) zurückgezogen ist, um zu ermöglichen, dass zumindest ein Teil des Suture Ankers (300) in dem distalen Ende (190) des axialen Gangs (100, 203) aufgenommen werden kann, und (ii) einer zweiten ausgefahrenen Position, wobei die distale Endfläche (55) des Schafts aus der distalen Endfläche (190) des axialen Gangs (100, 203) herausragt zu bewegen; 35

eine ringförmige Rippe (90), die außerhalb des axialen Gangs (100, 203) und auf der äußeren Fläche des Gehäuses (15, 30) 40

ausgebildet ist;

eine nach innen zeigende Lippe (125) des Schafts (25), um die ringförmige Rippe (90) nachgebend einzurasten, weil der Schaft (25) sich von seiner ersten eingezogenen Position zu seiner zweiten ausgefahrenen Position bewegt, wobei das Zusammenspiel der ringförmigen Rippe (90) und der nach innen zeigenden Lippe (125) den Schaft (25), wenn er sich in seiner ersten zurückgezogenen Position befindet daran hindert, sich in seine zweite ausgeführte Position zu bewegen, bis eine ausreichende distal-gerichtete Kraft auf den Schaft (25) ausgeübt wird und auf diese Weise die nach innen gerichtete Lippe (125) aus der Verbindung mit der ringförmigen Rippe (90) zu lösen; und 45

Suture-Fadenhandhabungsmittel zur Handhabung eines freien Endes eines Suture-Fadens (315), welches an dem Suture Anker (300) befestigt ist, wenn der Suture Anker in dem distalen Ende (190) des axialen Gangs angeordnet ist, wobei das Suture-Faden Handhabungsmittel eine Aussparung (140, 145, 160) aufweist, die eine erste Fläche und ein in der Aussparung (140, 145, 160) angeordnetes Elastomer (37) definiert, um die erste Oberfläche nachgebend zu befestigen wobei ein freies Ende eines Suturefadens (315) zwischen die erste Fläche und das Elastomer (37) gezwungen werden und dort belassen werden kann bis es gewaltsam zurückgezogen wird, wobei die nach innen gerichtete Lippe (125) mit dem Schaft verbunden ist. 50

Revendications

1. Outil d'installation (5) pour déployer un élément d'ancrage (300) dans un os (325) ledit outil d'installation (5) comprenant : 55

un corps (15, 30) ayant une partie distale et une partie proximale, ladite partie distale se terminant dans une surface d'extrémité distale (190) et ladite partie proximale se terminant dans une surface d'extrémité proximale, et dans lequel, en outre, un passage axial (100, 203) s'étend entre ladite surface d'extrémité distale (190) et ladite surface d'extrémité proximale, ladite surface d'extrémité distale (190) dudit passage axial étant dimensionnée de manière à recevoir au moins une partie dudit élément d'ancrage (300) dans celle-ci ; 60

un arbre (25) disposé de manière coulissante dans ledit passage axial (100, 203), ledit arbre

(25) se terminant dans une surface d'extrémité distale (55) et étant adapté à se déplacer entre (i) une première position rétractée dans laquelle ladite surface d'extrémité distale de l'arbre (55) est extraite suffisamment loin à l'intérieur dudit passage axial (100, 203) pour permettre au moins à une partie dudit élément d'ancrage (300) d'être reçue dans ladite extrémité distale (190) dudit passage axial (100, 203), et (ii) une seconde position étendue dans laquelle ladite surface d'extrémité distale de l'arbre (55) se projette en dehors de ladite surface d'extrémité distale (190) dudit passage axial (100, 203) ; une nervure annulaire (90) formée sur la surface extérieure dudit corps (15, 30) ; et

caractérisé par une lèvre tournée vers l'intérieur (125) dudit arbre (25) pour venir en prise de manière déformable avec ladite nervure annulaire (90) lorsque ledit arbre (25) se déplace depuis ladite première position rétractée jusqu'à sa dite seconde position étendue, de façon que lorsque ledit arbre (25) est dans sa dite première position rétractée, l'interaction entre ladite nervure annulaire (90) et ladite lèvre tournée vers l'intérieur (125) empêche ledit arbre (25) de se déplacer dans sa dite seconde position étendue jusqu'à ce qu'une force suffisante dirigée de façon distale soit appliquée audit arbre (25) de manière à déformer ladite lèvre tournée vers l'intérieur (125) en se dégageant de ladite nervure annulaire (90) ; et en ce que ladite nervure annulaire (90) est formée à l'extérieur dudit passage axial (100, 203) et ladite lèvre tournée vers l'intérieur (125) est reliée audit arbre (25).

2. Outil d'installation (5) selon la revendication 1, dans lequel ledit outil d'installation comprend, en outre, un moyen de gestion de suture pour gérer une extrémité libre d'une suture (315) fixée audit élément d'ancrage (300) disposé dans ladite extrémité distale (190) dudit passage axial (100, 203), ledit moyen de gestion de suture comprenant une cavité (140, 145, 160) définissant une première surface et un élastomère (37) disposé dans ladite cavité (140, 145, 160) pour venir en prise de façon déformable avec ladite première surface, de telle sorte qu'une extrémité libre d'une suture (315) puisse être forcée entre ladite première surface et ledit élastomère (37) et retenue à cet endroit jusqu'à être retirée par force après cela.

3. Outil d'installation (5) selon la revendication 1

dans lequel ledit arbre (25) comprend, en outre, une première partie (40) ayant une première section transversale, une seconde partie (45) ayant une seconde section transversale inférieure à ladite première section transversale et un épaulement (50) défini par l'intersection de ladite première et de

ladite seconde partie (40, 45) ;

dans lequel ledit corps (15, 30) comprend un doigt de préhension cannelé (65) et une tige (70) s'étendant de façon distale par rapport audit doigt de préhension cannelé (65), ladite tige (70) incluant une partie filetée (75) et se terminant par un nez chanfreiné (80) ; dans lequel ladite lèvre tournée vers l'intérieur (125) est reliée audit arbre (25) par une poignée d'arbre (35) adaptée à recevoir de manière fixe une extrémité proximale (60) dudit arbre (25), ladite poignée d'arbre (25) comprenant une partie cylindrique fendue (105) formant ladite lèvre tournée vers l'intérieur (125) disposée sur une extrémité distale de celle-ci, ladite partie cylindrique fendue (105) incluant, en outre, quatre fentes (130), chacune desdites fentes (130) étant positionnée circonférentiellement en relation opposée espacée par rapport à celle-ci, définissant quatre doigts s'étendant longitudinalement adaptés à saisir ladite nervure annulaire (90) dudit corps (30), une bride fendue (110) disposée à une extrémité proximale de ladite partie cylindrique fendue (105), ladite bride fendue (110) ayant quatre fentes (135) dont chacune est disposée circonférentiellement en relation opposée espacée et un poteau en forme de T (115) s'étendant depuis une surface proximale (140) de ladite bride fendue (110) et adapté à maintenir une extrémité libre de suture, ledit poteau en forme de T (115) comprenant une colonne centrale (145) ayant un trou (70) adapté à recevoir de manière fixe ladite extrémité proximale (60) dudit arbre (25) et une bride (150) disposée à une extrémité proximale (155) de ladite colonne centrale (145), ladite colonne centrale (145) s'étendant de façon distale par rapport à une surface interne plate (160) de ladite bride (150) ; et

un oeillet caoutchouté (37) disposé autour de ladite colonne centrale (145) et adapté à maintenir de façon amovible une certaine longueur de suture (315) fixée audit élément d'ancrage de suture (300) ;

un manchon (15) comprenant une extrémité proximale évasée (200) et une extrémité distale fendue (190), ledit manchon (15) étant adapté à recevoir ledit arbre (25) de manière coulissante ; et dans lequel ledit corps comprend, en outre, une poignée de manchon (20) comprenant une partie proximale (210) et se terminant dans une extrémité proximale plate (220), une partie distale (205) se terminant dans une extrémité distale arrondie (215) et un alésage (225) s'étendant entre ladite extrémité proximale (220) et ladite extrémité distale arrondie (215), ladite poignée de manchon (20) étant adaptée à recevoir de manière coulissante ledit manchon (15), ladite partie proximale (210) de ladite poignée de manchon (20) incluant, en outre, un lamage intérieur taraudé (230) adapté à fixer de manière amovible ladite partie filetée (75) de ladite

- tige (70), ledit lamage intérieur taraudé (230) et ledit alésage (225) se rencontrant au niveau d'un épaulement interne incliné (235) pour venir en prise avec ladite extrémité proximale évasée (200) dudit manchon (15), ladite poignée de manchon (20) comprenant, en outre, des dépressions de doigts de saisie (245) disposées selon une relation circonférentielle opposée sur celle-ci et adaptées à recevoir un pouce et les doigts d'un utilisateur pendant l'installation dudit élément d'ancrage de suture (300). 5 10
4. Outil d'installation selon la revendication 3, dans lequel les première et seconde sections transversales dudit arbre (25) sont cylindriques. 15
5. Outil d'installation selon la revendication 3, dans lequel ledit doigt de préhension cannelé (65) comprend une pluralité de cannelures disposées circonférentiellement. 20
6. Outil d'installation selon la revendication 3, dans lequel ladite bride (110) de ladite poignée d'arbre (35) comprend, en outre, une surface proximale arrondie (140) et une surface distale plate (137) de façon à définir un bord circonférentiel arrondi (142) entre elles. 25
7. Outil d'installation selon la revendication 3, dans lequel ladite extrémité proximale (60) dudit arbre (25) est soudée dans ledit trou (170) de ladite poignée d'arbre (35). 30
8. Système pour déployer un élément d'ancrage (300) dans un os pour entrer une suture dans un trou (320) formé dans un os (325), ledit système comprenant : 35
- (i) ledit élément d'ancrage de suture (300) comprenant un logement généralement cylindrique, une paire d'ardillons flexibles (310) s'étendant latéralement à l'extérieur du côté dudit logement, et un moyen de fixation de suture pour fixer une certaine longueur de suture (315) audit logement ; et 40
- (ii) un outil d'installation (5) pour déployer ledit élément d'ancrage (300) dans un os (325) ledit outil d'installation (5) comprenant : 45
- un corps (15, 30) ayant une partie distale et une partie proximale, ladite partie distale se terminant dans une surface d'extrémité distale (190) et ladite partie proximale se terminant dans une surface d'extrémité proximale, et dans lequel, en outre, un passage axial (100, 203) s'étend entre ladite surface d'extrémité distale (190) et ladite surface d'extrémité proximale, ladite surface d'extrémité distale (190) dudit passage 50 55

axial étant dimensionnée de manière à recevoir au moins une partie dudit élément d'ancrage (300) dans celle-ci ;

un arbre (25) disposé de manière coulissante dans ledit passage axial (100, 203), ledit arbre (25) se terminant dans une surface d'extrémité distale (55) et étant adapté à se déplacer entre (i) une première position rétractée dans laquelle ladite surface d'extrémité distale de l'arbre (55) est extraite suffisamment loin à l'intérieur dudit passage axial (100, 203) pour permettre au moins à une partie dudit élément d'ancrage de suture (300) d'être reçue dans ladite extrémité distale (190) dudit passage axial (100, 203), et (ii) une seconde position étendue dans laquelle ladite surface d'extrémité distale de l'arbre (55) se projette en dehors de ladite surface d'extrémité distale (190) dudit passage axial (100, 203) ;

une nervure annulaire (90) formée à l'extérieur dudit passage axial (100, 203) et sur la surface extérieure dudit corps (15, 30) ;

une lèvre tournée vers l'intérieur (125) dudit arbre (25) pour venir en prise de manière déformable avec ladite nervure annulaire (90) lorsque ledit arbre (25) se déplace depuis sa dite première position rétractée jusqu'à sa dite seconde position étendue, de façon que lorsque ledit arbre (25) est dans sa dite première position rétractée, l'interaction entre ladite nervure annulaire (90) et ladite lèvre tournée vers l'intérieur (125) empêche ledit arbre (25) de se déplacer dans sa dite seconde position étendue jusqu'à ce qu'une force suffisante dirigée de façon distale soit appliquée audit arbre (25) de manière à déformer ladite lèvre tournée vers l'intérieur (125) en se dégageant de ladite nervure annulaire (90) ; et

un moyen de gestion de suture pour gérer une extrémité libre d'une suture (315) fixée audit élément d'ancrage (300) lorsque ledit élément d'ancrage est disposé dans ladite extrémité distale (190) dudit passage axial, ledit moyen de gestion de suture comprenant une cavité (140, 145, 160) définissant une première surface et un élastomère (37) disposé dans ladite cavité (140, 145, 160) pour venir en prise de façon déformable avec ladite première surface, de telle sorte qu'une extrémité libre d'une suture (315) puisse être forcée entre ladite première surface et ledit élastomère (37) et retenue à cet endroit jusqu'à être retirée par force après cela,

dans lequel ladite lèvre tournée vers l'inté-

rieur (125) est reliée audit arbre (25).

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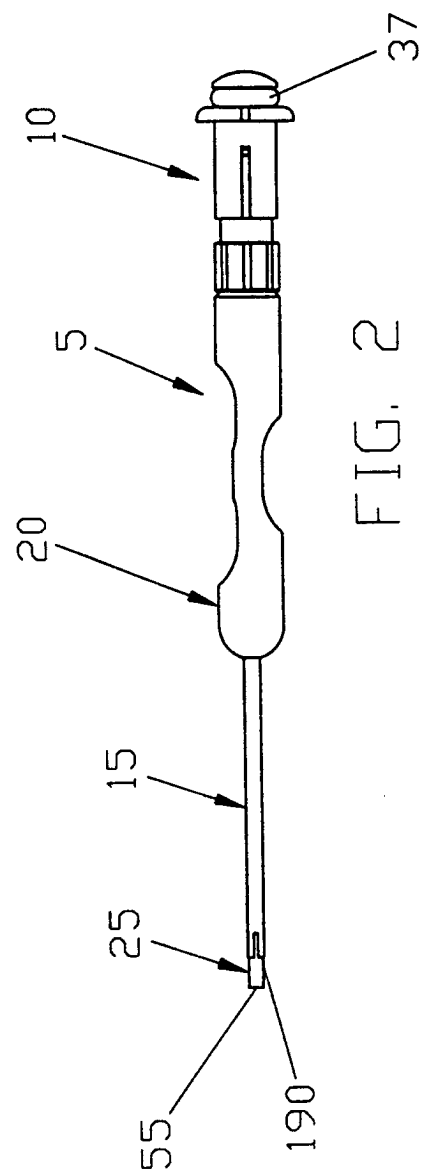
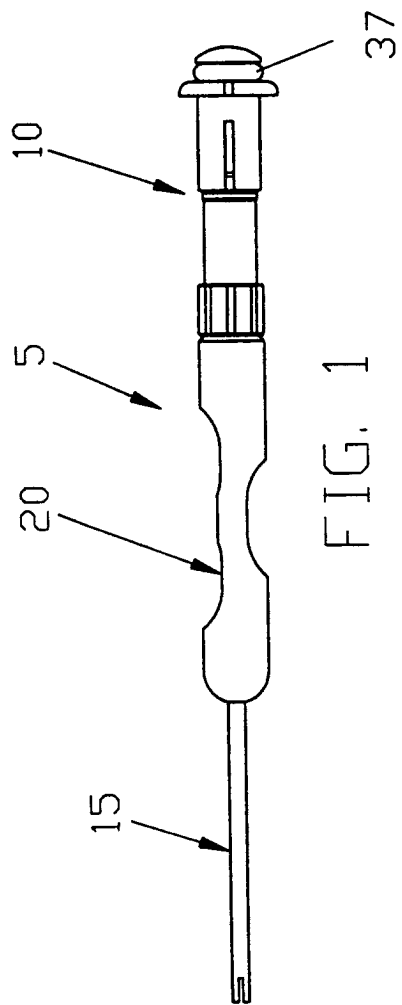
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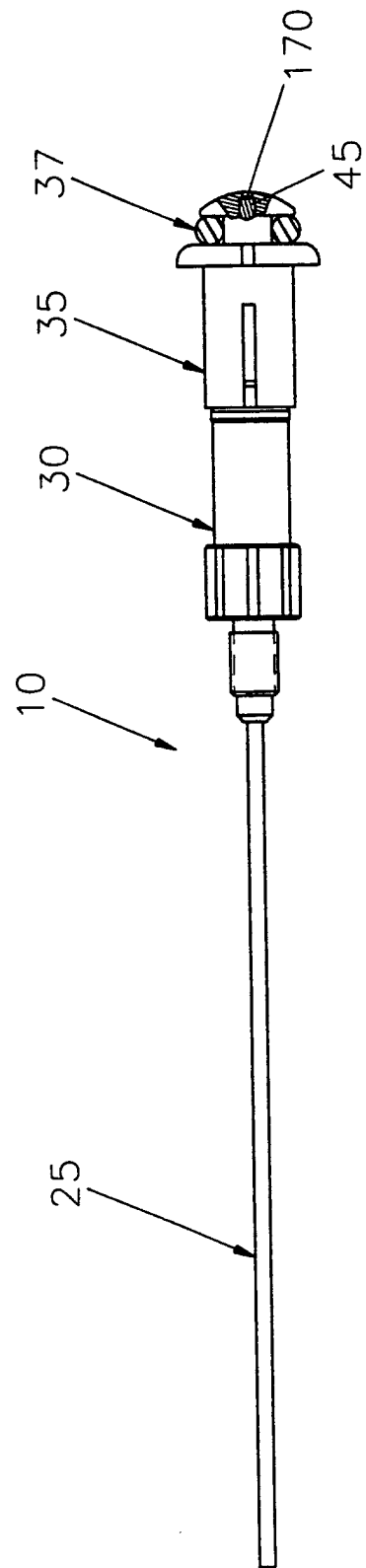


FIG. 3

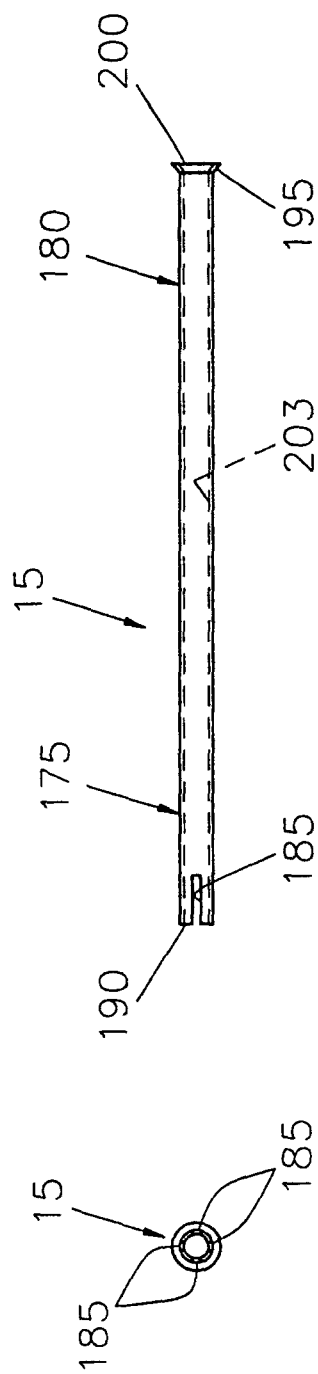


FIG. 4

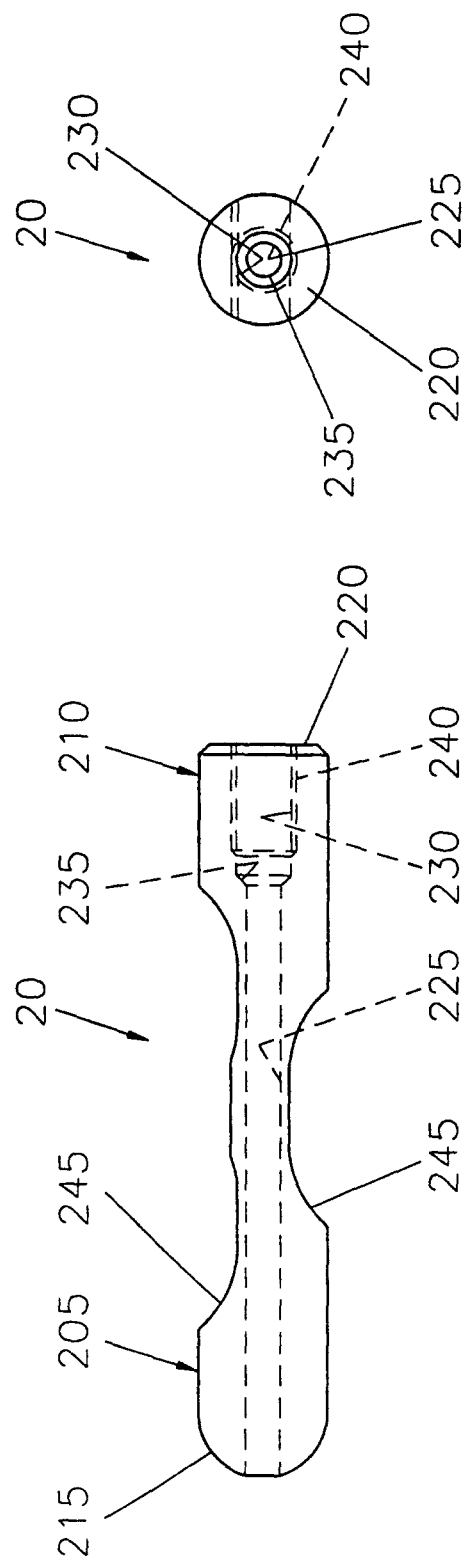


FIG. 5

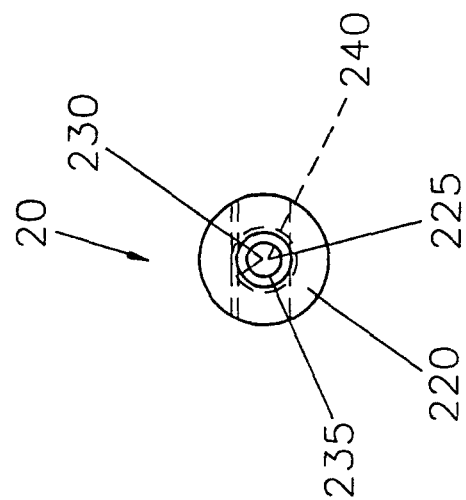


FIG. 6

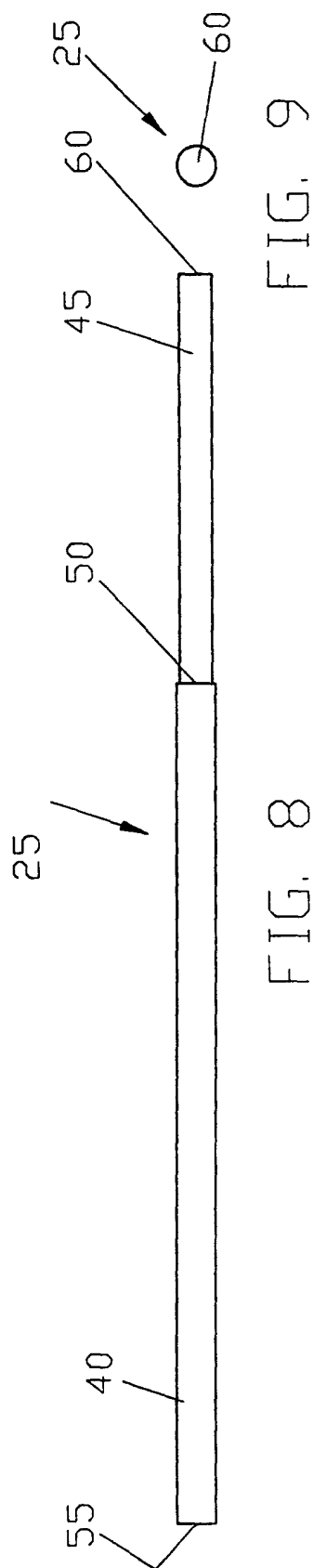


FIG. 9

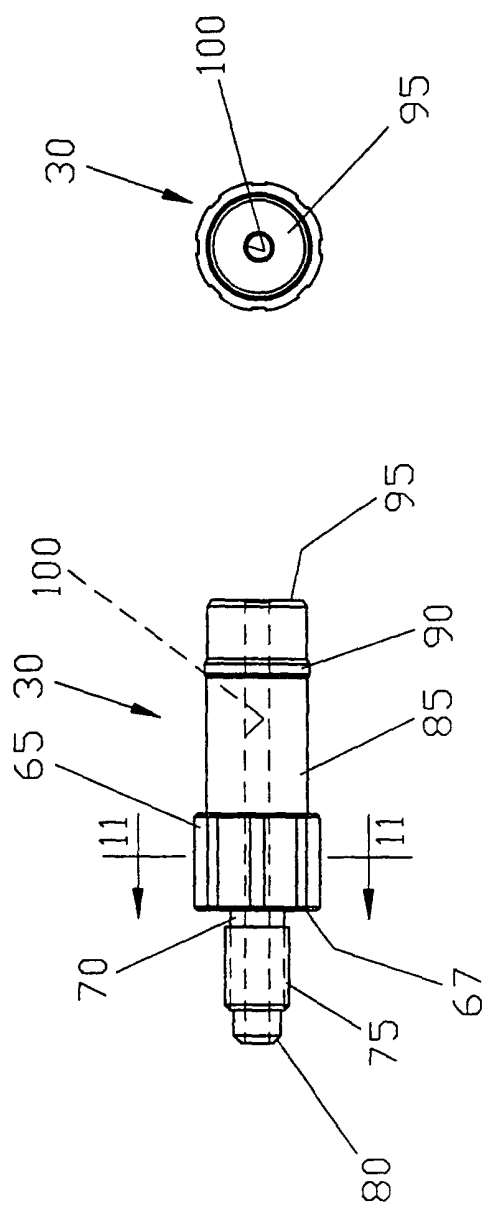
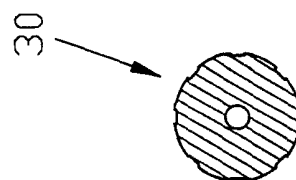


FIG. 12



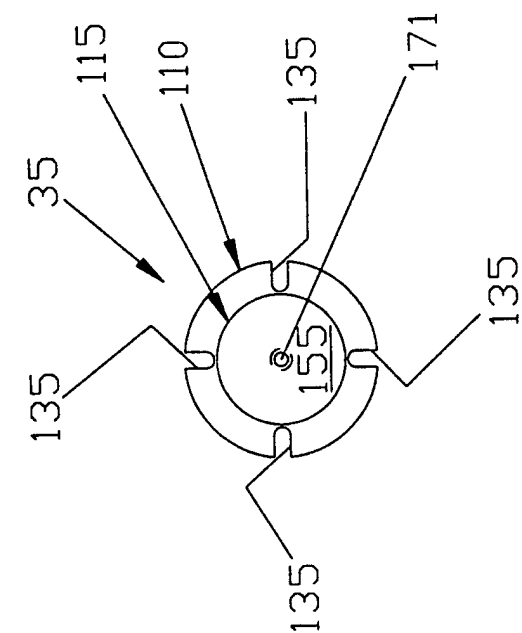


FIG. 14

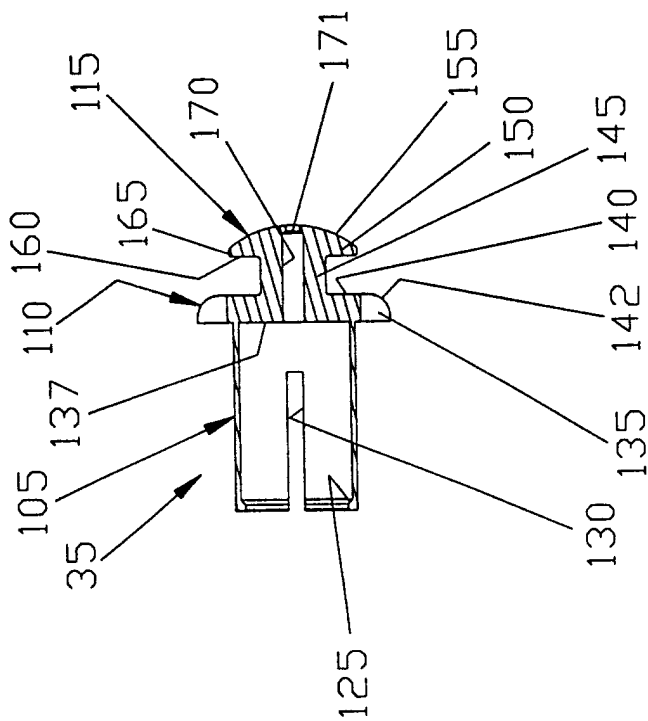


FIG. 13

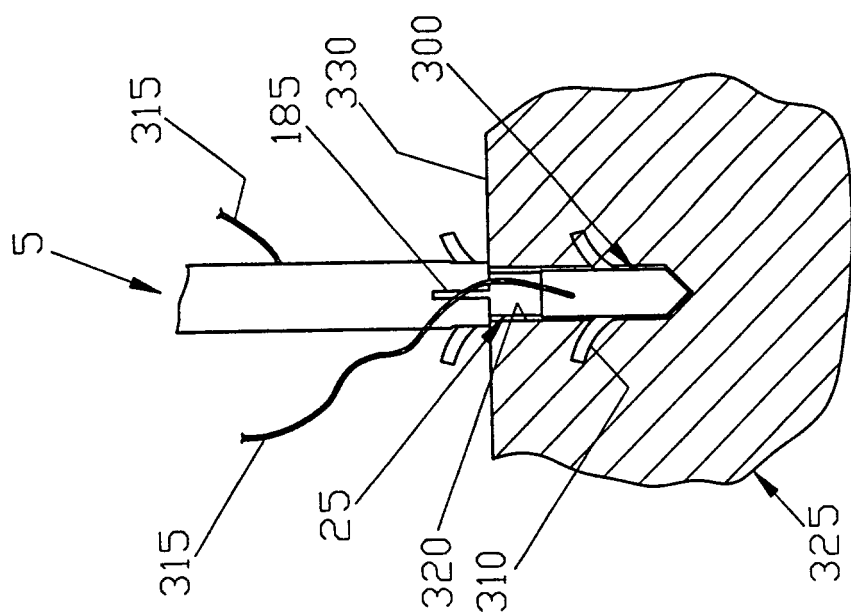


FIG. 17

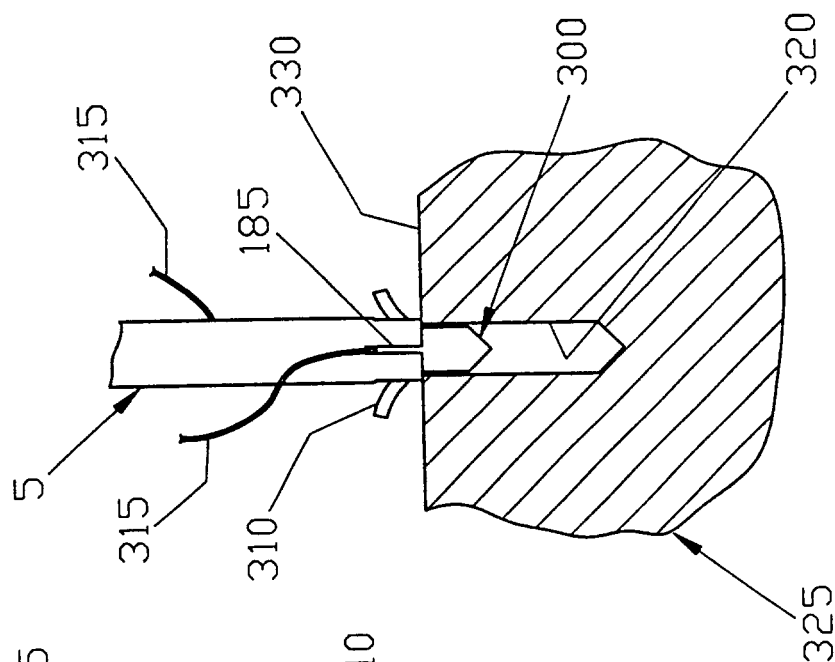


FIG. 16

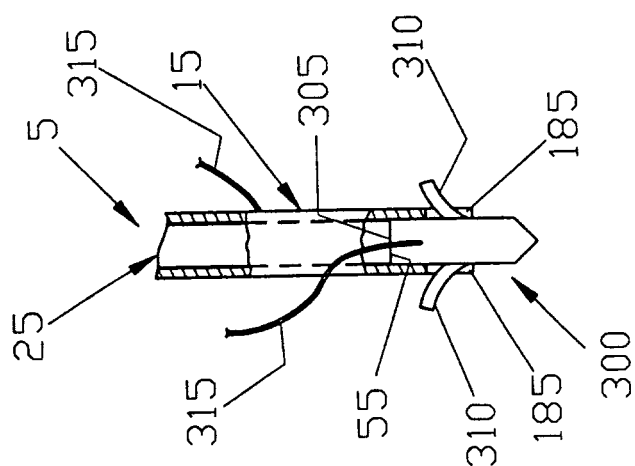


FIG. 15